(19)日本国特許庁（ＪＰ）　(12)公開特許公報（A）　(11)特許出願公開番号
特開2000－151163
（P2000－151163A）
(43)公開日　平成12年５月30日(2000.5.30)

(51)Int.Cl.⁷	識別記号	ＦＩ		テーマコード（参考）
Ｈ０５Ｋ　7/20		Ｈ０５Ｋ　7/20	Ｄ	５Ｅ３２２
Ｂ２１Ｄ　39/03		Ｂ２１Ｄ　39/03	Ｚ	

審査請求　未請求　請求項の数４　ＯＬ　（全 8 頁）

(21)出願番号　特願平10－327876

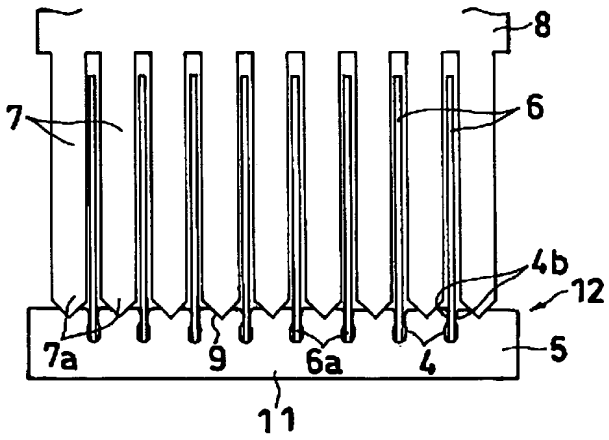
(22)出願日　平成10年11月18日(1998.11.18)

(71)出願人　000186843
昭和アルミニウム株式会社
大阪府堺市海山町６丁224番地
(71)出願人　598159229
株式会社エス・ティ・エス
川崎市中原区上平間684
(71)出願人　598159230
雨宮エンジニアリング株式会社
東京都大田区東糀谷４－４－10
(74)代理人　100060874
弁理士　岸本　瑛之助　（外４名）

最終頁に続く

(54)【発明の名称】　ヒートシンクの製造法

(57)【要約】
【課題】　簡単な構造のポンチの使用でよく、またフインを基板にかしめ止める前にフイン姿勢保持のための別の部品を必要としないようにする。
【解決手段】　ヒートシンクの製造法は、平板状基板の片面に所定間隔をおいてブレートフイン６の基部6aの肉厚より若干広い溝幅を有する溝４を多数並列状に形成し、基板５の各溝４にブレートフイン６の基部6aをはめ入れ、隣り合うブレートフイン６どうしの間および両端のブレートフイン６のすぐ外側に位置するようになされかつ横断面Ｖ状先端7aを有する板状部７を櫛歯状に備えたブレスのポンチ８により、各板状部７に対応する基板平坦部5aに板状部７の先端7aを押込み、各溝４にはめ込まれたブレートフィン６の基部6a両側をかしめ止めるものである。



1

【特許請求の範囲】

【請求項１】　平板状基板の両面のうち少なくとも片面に所定間隔をおいてブレートフインの基部の肉厚より若干広い溝幅を有する溝を多数並列状に形成する工程と、基板の各溝にブレートフインの基部をはめ入れる工程と、隣り合うブレートフインどうしの間および両端のブレートフインのすぐ外側に位置するようになされかつ横断面Ｖ状先端を有する板状部を櫛歯状に備えたブレスのポンチにより、各板状部に対応する基板平坦部に板状部の先端を押込み、各溝にはめ込まれたブレートフィンの基部両側をかしめ止める工程とよりなることを特徴とするヒートシンクの製造法。

【請求項２】　ブレートフイン基部嵌入用溝の両開口縁を横断面凸弧状に形成し、かしめ止め時、凸弧状部の一部をブレートフインの基部に面接触するように塑性変形せしめることを特徴とする請求項１記載のヒートシンクの製造法。

【請求項３】　基板の厚みが１～１０ｍｍ、ブレートフインの厚みが０．０５～２．０ｍｍ、ブレートフインの高さが１０～１５０ｍｍ、ブレートフインの中心間ピッチが１～１０ｍｍであることを特徴とする請求項１または２記載のヒートシンクの製造法。

【請求項４】　平板状基板の両面のうち少なくとも片面にコルゲートフインの波頂部の内幅より若干狭い間隔をおいてコルゲートフインの波頂部の外幅より若干広い溝幅を有する溝を多数形成する工程と、基板の溝にコルゲートフインの片方の波頂部をはめ入れる工程と、各溝に前記波頂部を介して波頂部の内幅より若干小さい横断面幅を有しかつ基板と同じ材質のかしめ用棒をはめ入れる工程と、コルゲートフインの隣り合う波間に位置するようになされかつ横断面Ｖ状先端を有する板状部を櫛歯状に備えたブレスのポンチにより、各板状部に対応するかしめ用棒に板状部の先端を押込み、溝にはめ込まれたコルゲートフインの波頂部の両側折曲げ垂直部の片側をかしめ止めるとともにその反対側を溝壁に圧接する工程とよりなることを特徴とするヒートシンクの製造法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ヒートシンクの製造法に関する。

【０００２】

【従来の技術】従来、ヒートシンクの製造法として、平板状基板の片面に所定間隔をおいてブレートフインの基部の肉厚より若干広い溝幅を有する条溝を多数並列状に形成するとともに、条溝２つずつを対として両溝間に開口端に向かって順次広がった凹溝を形成することにより、凹溝の両側に対峙状にかしめ用突壁部を設けかつかしめ用突壁に対向する壁を固定用突壁部となし、各溝にブレートフインの基部をはめ入れた後、対峙する両かしめ用突壁間に、条溝にそってかしめ用治具の押圧部を移動することにより、かしめ用突壁部をブレートフイン側に押圧し、ついで加工治具の膨隆突部を条溝にそって移動することにより、かしめ用突壁部の中間部をブレートフイン側に向かってく字状に圧潰し、ブレートフインを基板にかしめ止めるものが知られている（特許第２７１５８９０号公報参照）。

【０００３】

【発明が解決しようとする課題】従来の上記ヒートシンクの製造法によれば、複雑な構造の加工治具を必要とするのみならず、加工治具の押圧部および膨隆突部を条溝にそって移動させるものであるから、このさい各凹溝に基部がはめ込まれたブレートフインの姿勢を保持せしめねばならず、そのために幾つかの部品を必要とする。

【０００４】本発明の目的は、簡単な構造のポンチの使用でよく、また上記のようなフイン姿勢保持のための部品を必要としないヒートシンクの製造法を提供することにある。

【０００５】

【課題を解決するための手段】請求項１の発明によるヒートシンクの製造法は、平板状基板の両面のうち少なくとも片面に所定間隔をおいてブレートフインの基部の肉厚より若干広い溝幅を有する溝を多数並列状に形成する工程と、基板の各溝にブレートフインの基部をはめ入れる工程と、隣り合うブレートフインどうしの間および両端のブレートフインのすぐ外側に位置するようになされかつ横断面Ｖ状先端を有する板状部を櫛歯状に備えたブレスのポンチにより、各板状部に対応する基板平坦部に板状部の先端を押込み、各溝にはめ込まれたブレートフィンの基部両側をかしめ止める工程とよりなるものである。

【０００６】請求項２の発明によるヒートシンクの製造法は、請求項１の発明において、ブレートフイン基部嵌入用溝の両開口縁を横断面凸弧状に形成し、かしめ止め時、凸弧状部の一部をブレートフインの基部に面接触するように塑性変形せしめるものである。

【０００７】請求項３の発明によるヒートシンクの製造法は、請求項１または２の発明において、基板の厚みが１～１０ｍｍ、ブレートフインの厚みが０．０５～２．０ｍｍ、ブレートフインの高さが１０～１５０ｍｍ、ブレートフインの中心間ピッチが１～１０ｍｍであるものである。

【０００８】請求項４の発明によるヒートシンクの製造法は、平板状基板の両面のうち少なくとも片面にコルゲートフインの波頂部の内幅より若干狭い間隔をおいてコルゲートフインの波頂部の外幅より若干広い溝幅を有する溝を多数形成する工程と、基板の溝にコルゲートフインの片方の波頂部をはめ入れる工程と、各溝に前記波頂部を介して波頂部の内幅より若干小さい横断面幅を有しかつ基板と同じ材質のかしめ用棒をはめ入れる工程と、コルゲートフインの隣り合う波間に位置するようになさ

れかつ横断面Ｖ状先端を有する板状部を櫛歯状に備えたブレスのポンチにより、各板状部に対応するかしめ用棒に板状部の先端を押込み、溝にはめ込まれたコルゲートフインの波頂部の両側折曲げ垂直部の片側をかしめ止めるとともにその反対側を溝壁に圧接する工程とよりなるものである。

【０００９】上記において、基板、ブレートフインおよびコルゲートフインには、伝熱性のよいアルミニウムまたはアルミニウム合金（以下単に「アルミニウム」という）が使用される。

【００１０】

【発明の実施の形態】本発明の実施の形態を以下図面を参照して説明する。

実施の形態１

この実施の形態は、請求項１および２のヒートシンクの製造法を図１～図４および図７により示すものである。まず、鍛造により、アルミニウム製平板状基板の片面に所定間隔をおいてブレートフインの基部の肉厚より若干広い溝幅を有する溝を多数並列状に形成する。すなわち、平板状基板を第１ブレスのベッド(1) にのせ、櫛歯状垂下突条(2) を並列状に有する第１ブレスのポンチ(3) により加圧し、上記所定の溝(4) を有する基板(5) となす。このさい溝(4) には、その両開口縁を横断面凸弧状に形成し、凸弧状部(4a)を具備せしめるものであり、ポンチ(3) の櫛歯状垂下突条(2) の横断面をこれが形成せられる形状にすることによって得られる（図１参照）。上記溝(4) は、鍛造によって得たが、切削加工によって形成してもよい。

【００１１】つぎに、基板(5) を第２ブレスのベッド（図示略）に移し、基板(5) の各溝(4) にブレートフイン(6) の基部(6a)をはめ入れた後、隣り合うブレートフイン(6) どうしの間および両端のブレートフイン(6) のすぐ外側に位置するようになされかつ横断面Ｖ状先端(7a)を有する板状部(7) を櫛歯状に備えた第２ブレスのポンチ(8) （図２参照）により、各板状部(7) に対応する基板平坦部(5a)に板状部(7) の先端(7a)を押込み、これに横断面Ｖ状の押込み圧痕(9) をつけると同時に、各溝(4) にはめ込まれたブレートフイン(6) の基部(6a)両側をかしめ止める（図３参照）。このかしめ止め時、凸弧状部(4a)の一部をブレートフイン(6) の基部(6a)に面接触するように塑性変形せしめ、広い面接触のかしめ止め部(4b)を得る（図４参照）。板状部(7) の上下長さは、ブレートフイン(6) の基板(5) からの突出高さより、少なくともその先端(7a)を基板平坦部(5a)に押込むために降下移動する距離分長くなされている。

【００１２】溝には必ずしもその両開口縁に凸弧状部がなくてもよく、図５に示すように、角(10a) のあるような通常の溝(10)を形成してもよい。この場合は、図６にかしめ止め時、線接触に近い狭い面接触のかしめ止め部(10b) を得ることになる。したがって、ブレートフイン(6) のかしめ止め前の溝(4) には、その両開口縁に凸弧状部(4a)のある方が好ましい。

【００１３】上記の工程を経て図７に示すように、基板(5) のフインのある面と反対面が半導体素子等の発熱体取付面(11)となされたヒートシンク(12)を得るのであるが、かしめ止め前、ポンチ(8) には、基板(5) の各溝(4) にブレートフイン(6) の基部(6a)をはめ入れた後、隣り合うブレートフイン(6) どうしの間および両端のブレートフイン(6) のすぐ外側に位置するようになされた櫛歯状の板状部(7) を備えているので、各ブレートフイン(6) は、その両側から挟まれた状態になり、ブレートフイン(6) が倒れることを防止しうる。

【００１４】ブレートフインの形態は、図７に示すようななんの加工も施されていない方形状のものが一般的であるが、垂直方向の長孔(13)が複数あけられたブレートフイン(14)（図８参照）、上から垂直方向の長い切欠き(15)が複数あけられたブレートフイン(16)（図９参照）、基部(18a) を平らなまま残し、これから上方に平面からみて波状に屈曲した波状部(17)を有するブレートフイン(18)（図１０参照）および基部(19b) を平らなまま残し、これから上方を先細となしたテーパ部(20)を有するブレートフイン(19)（図１１参照）のようなものも適宜採用せられる。

【００１５】実施の形態２

この実施の形態は、請求項４のヒートシンクの製造法を図１２～図１３により示すものである。まず、実施の形態１と同じ要領で第１ブレスを用いて鍛造により、アルミニウム製平板状基板の片面に角付きコルゲートフイン(21)の波頂部(21a) の内幅(W1)より若干狭い間隔をおいてコルゲートフイン(21)の波頂部(21a) の外幅(W2)より若干広い溝幅を有する第１溝(22)を多数形成するとともに、両端の同溝(22)の外側にそれぞれ前記と同様の間隔をおいてコルゲートフイン(21)の垂直端部(21b)の肉厚より若干広い溝幅を有する第２溝(23)を形成し、２種類の溝(22)(23)を有する基板(24)を得る。

【００１６】つぎに、基板(24)を第２ブレスのベッド（図示略）に移し、基板(24)の第１溝(22)にコルゲートフイン(21)の片方の波頂部(21a) をはめ入れるとともに、基板(24)の第２溝(23)にコルゲートフイン(21)の垂直端部(21b) をはめ入れた後、第１溝(22)に前記波頂部(21a) を介して波頂部(21a) の内幅(W1)より若干小さい横断面幅を有しかつ基板(24)と同じ材質のかしめ用棒(25)をはめ入れる（図１２参照）。続いて、コルゲートフイン(21)の隣り合う波間および両端の垂直部のすぐ外側に位置するようになされかつ横断面Ｖ状先端(26a) を有する板状部(26)を、櫛歯状に備えた第２ブレスのポンチ(27)により、各板状部(26)に対応するかしめ用棒(25)および基板平坦部(24a) に板状部(26)の先端(26a) を押込み、これらに横断面Ｖ形の圧痕(35)をつけると同時に、第１溝(22)にはめ込まれたコルゲートフイン(21)の波頂

部(21a) の両側折曲げ垂直部の片側およびコルゲートフィン(21)の垂直端部(21b) の片側をかしめ止めるとともにこれらの反対側を溝壁に圧接し、基板(24)のフインのある面と反対面が発熱体取付面(28)となされたヒートシンク(29)を得る。

【００１７】このかしめ止め時、かしめ用棒(25)の上角(25a) および溝(23)の外上角(23a)をコルゲートフイン(26)の波頂部(21a) の両側折曲げ垂直部の片側およびコルゲートフイン(21)の垂直端部(21b) の片側に接触するように塑性変形せしめ、狭い面接触のかしめ止め部(25b)(23b)を得る。

【００１８】上記の工程を経てヒートシンク(29)を得るのであるが、かしめ止め前、基板(24)の第１溝(22)にコルゲートフイン(21)の片方の波頂部(21a) をはめ入れるとともに、基板(24)の第２溝(23)にコルゲートフイン(21)の垂直端部(21b) をはめ入れた後、第１溝(22)に前記波頂部(21a) を介してかしめ用棒(25)をはめ入れるので、コルゲートフイン(21)は正しくその姿勢を保つ。なお、コルゲートフインの両側が図示のように垂下状でなく、立上り状のものでは、第２溝(23)は不必要である。

【００１９】実施の形態３

この実施の形態は、図１～図４および図７のヒートシンクの製造法と異なる請求項１および４のヒートシンクの製造法を図１４により示すものであり、これは基板(30)の両面にフイン(31)(32)を片寄って具備せしめ、残りの両側平坦面を発熱体取付面(33)となしたヒートシンク(34)を得るものである。両発熱体取付面(33)は必要に応じいずれかの片面または両面が使用される。フインの形態は、上記したプレートフインおよびコルゲートフインのいずれでもよい。

【００２０】

【実施例】図７のヒートシンクにおいて、基板(5) の厚み(tb)を５．０ｍｍ、プレートフイン(6) の厚み(tf)を１．０ｍｍ、プレートフイン(6) の高さ(H) を２０．０ｍｍ、プレートフイン(6) の長さ(L) を７５．０ｍｍ、、プレートフイン(6) の中心間ピッチ(P) を５．０ｍｍとする。

【００２１】この実施例と、上記寸法と同寸法で基板とプレートフインをろう付けした比較例において、風速を変化させて熱抵抗を調べた結果を図１５のグラフに示す。同グラフの線（イ）が実施例のものであり、線（ロ）が比較例のものであるが、両者に熱抵抗の差がなく、同等の性能を発揮していることか分かる。上記実施例のヒートシンクにおいて、いま各部の寸法を変えた場合のフイン効率および熱抵抗を以下に示す。

【００２２】図１６は、基板の厚み(tb)とフイン効率の関係を示す。基板の厚み(tb)が厚いほど、全体のフイン効率は向上するが、厚すぎると重量が顕著に増加するため現実的ではない。また、薄すぎると極端に全体のフイン効率が低下する。したがって、基板の厚み(tb)は１～１０ｍｍが適当な範囲（Ａ）である。

【００２３】図１７は、比較的低風速条件でのプレートフインの厚み(tf)を変えた場合のフイン効率を示す。厚み(tf)が０．０５ｍｍ未満ではフイン効率が極端に低下し、厚み(tf)が増せばフイン効率が向上するが、厚すぎるとヒートシンクの重量が増加して、現実的ではない。したがって、プレートフインの厚み(tf)は、０．０５～２．０ｍｍの範囲（Ｂ）が適当である。

【００２４】図１８は、プレートフインの高さ(H) とフイン効率の関係を示す。プレートフインの高さ(H) は低いほどよいが、低すぎると伝熱面積の増加が減少するため放熱効果が小さくなるので、現実的な下限としては１０ｍｍであり、一方フイン効率を考慮すると上限値は１００ｍｍであると考えられるので、プレートフインの高さ(H) の適当な範囲（Ｃ）は、１０～１００ｍｍである。

【００２５】図１９は、プレートフインの中心間ピッチ(P) と熱抵抗の関係を示す。プレートフインの中心間ピッチ(P) が５ｍｍを超えると伝熱面積が減少し、熱伝達率も低下するため熱抵抗は大きくなる。また、プレートフインの中心間ピッチ(P) が小さいほど熱抵抗は小さくなるが、大きくなりすぎると境界層が隣り合ったプレートフインの境界層と合体するため、フイン効率が小さくなる。さらに、プレートフインの中心間ピッチ(P) が小さすぎると圧力損失が極端に増大し、現実的ではない。したがって、プレートフインの中心間ピッチ(P) は０．５～５．０ｍｍの範囲（Ｄ）が適当である。

【００２６】

【発明の効果】本発明のヒートシンクの製造法によれば、簡単な構造のポンチの使用でよく、またフインのかしめ止めの前フイン姿勢保持のために特に別の部品を必要としないので、ヒートシンクの製造を安価かつ能率的に行ないうる。

【図面の簡単な説明】

【図１】鍛造より基板に溝を形成する状態を切欠いた正面図である。

【図２】本発明の実施の形態１においてプレートフインを基板にかしめ止める前の状態を示す正面図である。

【図３】同プレートフインを基板にかしめ止めた後の状態を示す正面図である。

【図４】図３において基板にプレートフインの基部をかしめ止めた状態を示す部分詳細拡大断面図である。

【図５】基板に角のある通常の溝を設けこれにプレートフインの基部をはめ込んだ状態を示す部分断面図である。

【図６】図５の溝を有する基板にプレートフインの基部をかしめ止めた図４に相当する断面図である。

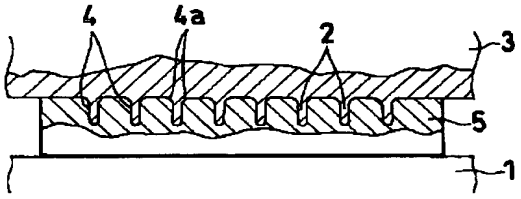
【図７】実施の形態１により製造されたヒートシンクの部分斜視図である。

【図８】プレートフインの第１変形例を示す斜視図であ

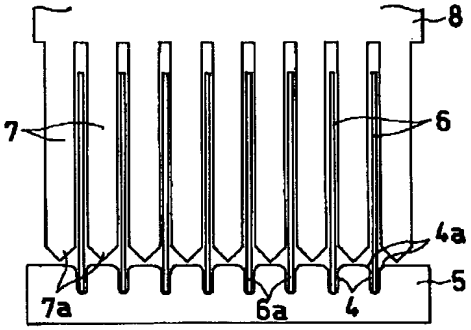
る。
【図９】ブレートフインの第２変形例を示す斜視図である。
【図１０】ブレートフインの第３変形例を示す斜視図である。
【図１１】ブレートフインの第４変形例を示す斜視図である。
【図１２】本発明の実施の形態２においてブレートフインを基板にかしめ止める前の状態を示す正面図である。
【図１３】同ブレートフインを基板にかしめ止めた後の状態を示す正面図である。
【図１４】本発明の実施の形態３により得られたヒートシンクの側面図である。
【図１５】実施例と比較例における風速を変化した場合の熱抵抗を示すグラフである。
【図１６】基板の厚みとフイン効率の関係を示すグラフである。
【図１７】比較的低風速条件でのブレートフインの厚みを変えた場合のフイン効率を示すグラフである。
【図１８】ブレートフインの高さとフイン効率の関係を示すグラフである。
【図１９】ブレートフインの中心間ピッチと熱抵抗の関＊係を示すグラフである。

【符号の説明】
(2)　：櫛歯状垂下突条
(3)(8)(27)：ポンチ
(4)　：溝
(4a)：凸弧状部
(4b)(10b)(23b)(25b)　：かしめ止め部
(5)(24)(30)　：基板
(5a)(24a)　：基板平坦部
(6a)(18a)(19b)：ブレートフインの基部
(7)(26)　：板状部
(7a)(26a)　：板状部の横断面Ｖ状先端
(12)(29)(34)：ヒートシンク
(6)(14)(16)(18)(19)　：ブレートフイン
(21)：コルゲートフイン
(21a)　：コルゲートフインの波頂部
(21b)　：コルゲートフインの垂直端部
(22)：第１溝
(23)：第２溝
(25)：かしめ用棒
(W1)：波頂部の内幅
(W2)：波頂部の外幅

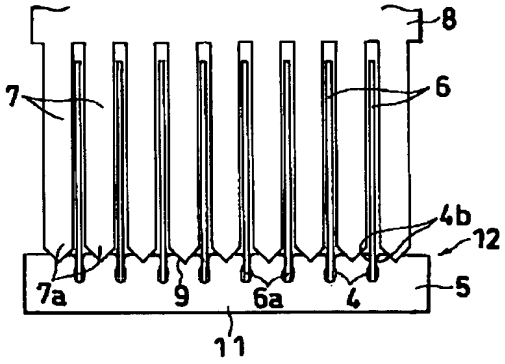
【図１】



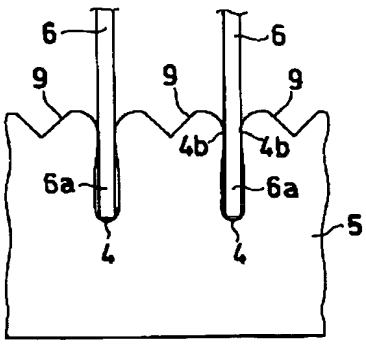
【図２】



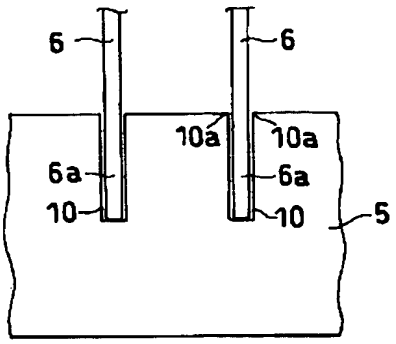
【図３】



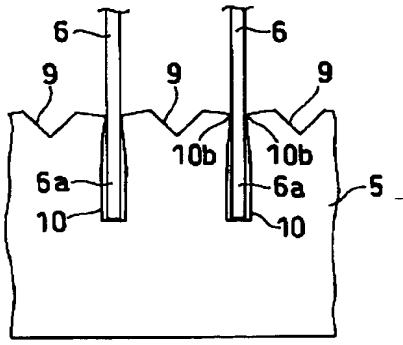
【図４】



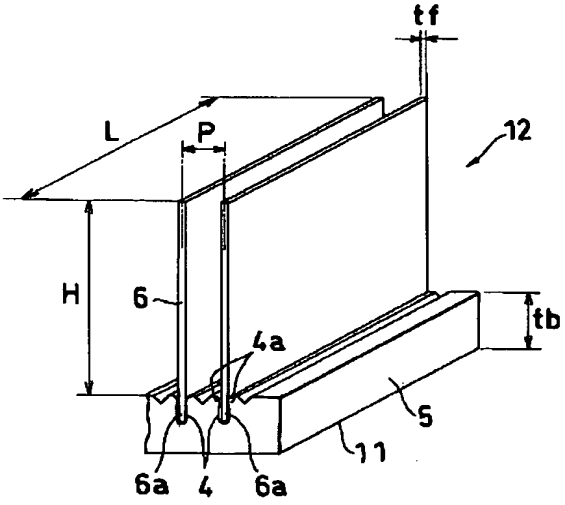
【図５】



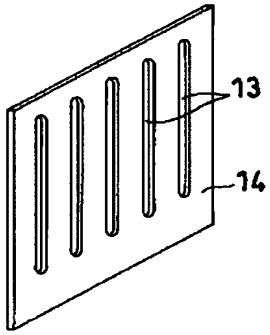
【図６】



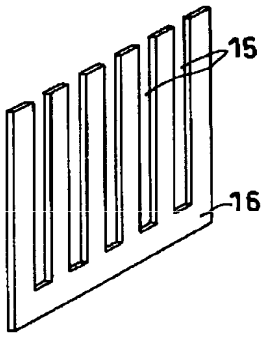
【図７】



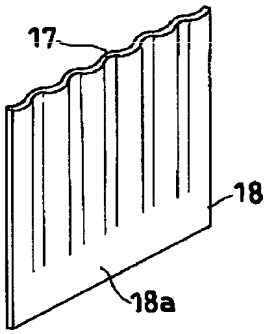
【図８】



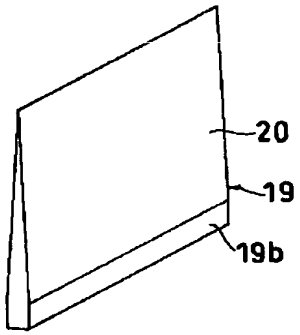
【図９】



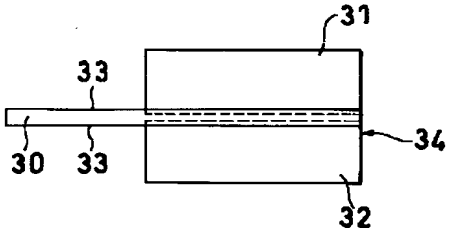
【図１０】



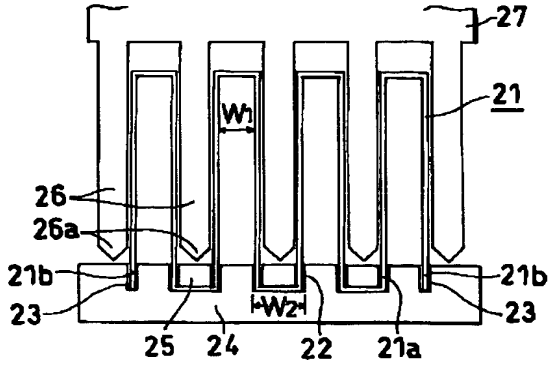
【図１１】



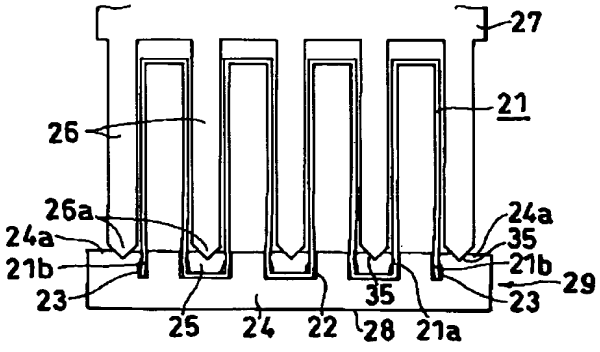
【図１４】



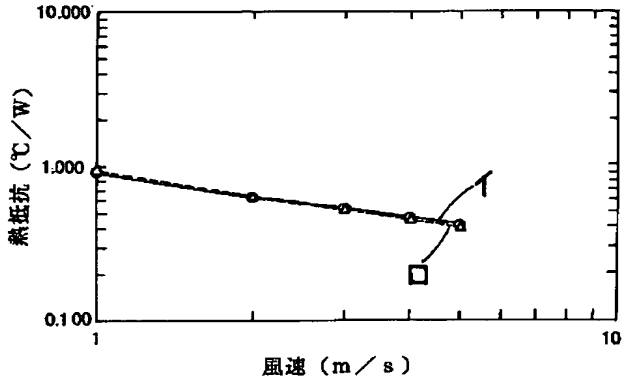
【図１２】



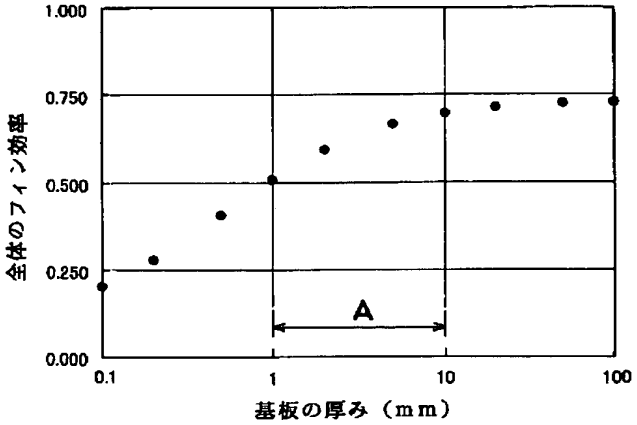
【図１３】



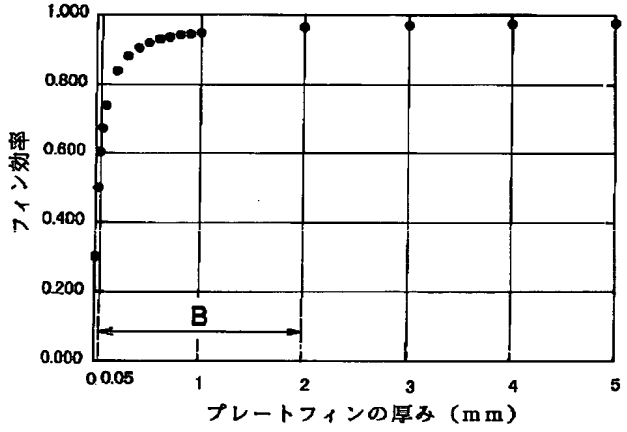
【図１５】



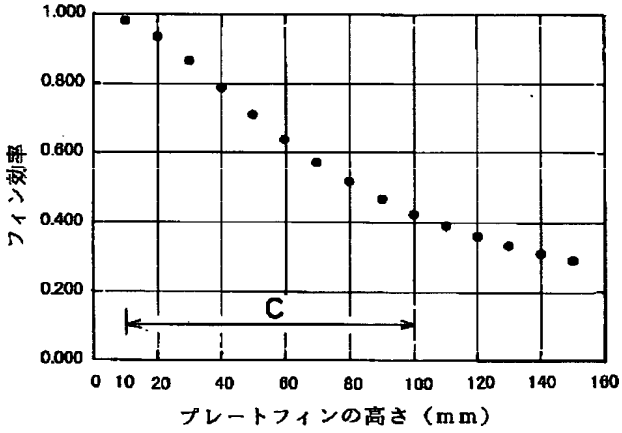
【図１６】



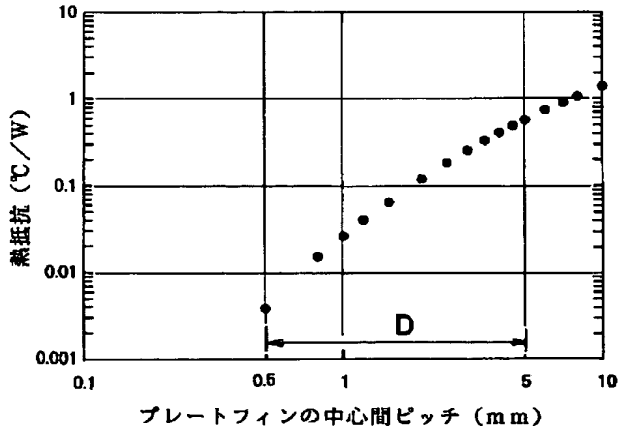
【図１７】



【図１８】



【図１９】



フロントページの続き

(72)発明者　浜野　秀光
堺市海山町６丁224番地　昭和アルミニウム株式会社内

(72)発明者　雨宮　澄男
東京都大田区東糀谷４－４－10　雨宮エンジニアリング株式会社内

(72)発明者　佐々木　隆
川崎市中原区上平間684　株式会社エス・ティ・エス内

Ｆターム(参考)　5E322 AA01 AA11

* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

Bibliography.

---

(19) [Country of Issue] Japan Patent Office (JP)
(12) [Official Gazette Type] Open patent official report (A)
(11) [Publication No.] JP,2000-151163,A (P2000-151163A)
(43) [Date of Publication] May 30, Heisei 12 (2000. 5.30)
(54) [Title of the Invention] The manufacturing method of a heat sink.
(51) [The 7th edition of International Patent Classification]

H05K 7/20
B21D 39/03

[FI]

H05K 7/20 D
B21D 39/03 Z

[Request for Examination] Un-asking.
[The number of claims] 4.
[Mode of Application] OL.
[Number of Pages] 8.
(21) [Filing Number] Japanese Patent Application No. 10-327876.
(22) [Filing Date] November 18, Heisei 10 (1998. 11.18)
(71) [Applicant]
[Identification Number] 000186843.
[Name] Showa Aluminum Corp.
[Address] 6, Kaisan-cho, Sakai-shi, Osaka dish 224 street.
(71) [Applicant]
[Identification Number] 598159229.
[Name] Incorporated company id tee id.
[Address] 684, Kami-hirama, Nakahara-ku, Kawasaki-shi.
(71) [Applicant]
[Identification Number] 598159230.
[Name] Amemiya Engineering.
[Address] 4-4-10, Higashi-Kojiya, Ota-ku, Tokyo.
(72) [Inventor(s)]
[Name] Hamano Hidemitsu.
[Address] 6, Kaisan-cho, Sakai-shi dish 224 street Inside of Showa Aluminum Corp.
(72) [Inventor(s)]
[Name] Amemiya Sumio.
[Address] 4-4-10, Higashi-Kojiya, Ota-ku, Tokyo Insid of Amemiya Engine ring.
(72) [Inventor(s)]
[Name] Sasaki **.
[Address] 684, Kami-hirama, Nakahara-ku, Kawasaki-shi Inside of incorporated company S t S.

(74) [Attorney]
[Identification Number] 100060874.
[Patent Attorn y]
[Name] Kishimoto ****** (besides four persons)
[Theme code (reference)]

Five E322.

[F term (reference)]

5E322 AA01 AA11.

[Translation done.]

* NOTICES *

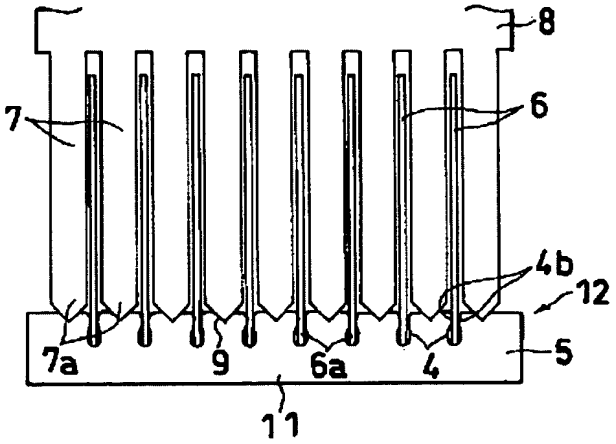
1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

Summary.

---

(57) [Abstract]
[Technical problem] Use of the punch of easy structure is sufficient, and before closing a fin to a substrate and stopping it, it is made not to need another parts for fin posture maintenance.
[Means for Solution] The manufacturing method of a heat sink forms many slots 4 which set a predetermined interval on one side of a plate-like substrate, and have a flute width [a little] larger than the thickness of base 6a of the plate fin 6 in the shape of parallel. With the punch 8 of the press which inserted base 6a of the plate fin 6 in each slot 4 of a substrate 5, and was equipped with the plate-like part 7 of the plate fin 6 of between adjacent plate fin 6 and ends which is made as [locate / outside / immediately] and has cross-section V-like nose-of-cam 7a in the shape of a ctenidium Nose-of-cam 7a of a plate-like part 7 is stuffed into substrate flat part 5a corresponding to each plate-like part 7, and the base 6a both sides of the plate fin 6 inserted in each slot 4 are closed and stopped. It is.

[Translation done.]



[Translation done.]

* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The manufacturing method of the heat sink characterized by the bird clapper from the process which closes and stops the base both sides of the plate fin which stuffed the nose of cam of a plate-like part into the substrate flat part corresponding to each plate-like part, and was inserted in each slot with the punch of the press equipped with the plate-like part in the shape of a ctenidium characterized by providing the following. The process which forms many slots which set a predetermined interval at least on one side among both sides of a plate-like substrate, and have a flute width [a little] larger than the thickness of the base of a plate fin in the shape of parallel. The process which inserts the base of a plate fin in each slot on the substrate. the plate fin of between adjacent plate fins and ends -- do to be located immediately outside -- and a cross-section V-like nose of cam
[Claim 2] The manufacturing method of the heat sink according to claim 1 which forms both the openings edge of the slot for plate fin base insertion in a cross-section convex arc, and is characterized by making it deform plastically so that field contact of a part of convex arc section may be carried out in the base of a plate fin at the time of a caulking stop.
[Claim 3] The manufacturing method of the heat sink according to claim 1 or 2 with which thickness of a substrate is characterized by the height of 0.05-2.0mm and a plate fin being [the pitch between centers of 10-150mm and a plate fin] 1-10mm for the thickness of 1-10mm and a plate fin.
[Claim 4] The manufacturing method of th heat sink charact rized by th bird clapper from the process which carries out the pressure welding of the opposit side to a groove face whil closing and stopping one side of the both-sides folding vertical section of the wave-crest section of the corrugat d fin which stuffed the nose of cam of a plate-lik part into the rod for

caulkings corresponding to each plate-lik part, and was inserted in the slot with the punch of the press equipped with the plate-like part in th shape of a ct nidium characteriz d by providing the following. The process which forms many slots which set an interval [a little] narrower than the inner width of face of the wave-crest s ction of a corrugated fin at least on one sid among both sid s of a plate-like substrate, and have a latus flute width a little from width of face outside the wave-crest section of a corrugated fin. The process which inserts the wave-crest section of one of the two of a corrugated fin in the slot on the substrate. The process which has cross-section width of face [a little] smaller than the inner width of face of the wave-crest section, and inserts the rod for caulkings of the same quality of the material as a substrate in each slot through the aforementioned wave-crest section. It is made as [locate / in the waves which a corrugated fin adjoins], and is a cross-section V-like nose of cam.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the manufacturing method of a heat sink.
[0002]
[Description of the Prior Art] While forming conventionally many laesuras which set a predetermined interval on one side of a plate-like substrate, and have a latus flute width a little from the thickness of the base of a plate fin as a manufacturing method of a heat sink in the shape of parallel By forming the concave which spread one by one toward the opening edge among both slots by making two laesuras at a time into a pair The wall which prepares the convex wall section for caulkings in the both sides of a concave in the shape of confrontation, and counters the convex wall for caulkings The convex wall section for fixation, and nothing, By meeting a laesura and moving the press section of the fixture for caulkings between the convex walls for both caulkings which confront each other, after inserting the base of a plate fin in each slot By pressing the convex wall section for caulkings to a plate fin side, meeting and subsequently to a laesura, moving the bulge projected part of a processing fixture The pars intermedia of the convex wall section for caulkings is crashed in the shape of **** toward a plate fin side, and what closes a plate fin to a substrate and stops it is known (refer to the patent No. 2715890 official report).
[0003]
[Problem(s) to be Solved by the Invention] According to the manufacturing method of the conventional above-mentioned heat sink, since it not only needs the processing fixture of complicated structur , but the press section and the bulge projected part of a processing fixture are met and moved to a laesura, th posture of a plate fin in which the base was inserted in each concave at this tim must be made to hold, and, for the reason, some parts are needed.
[0004] The purpose of this invention is to offer th manufacturing method of th heat sink which

use of the punch of easy structure is sufficient as, and does not need the parts for the above fin posture maintenance.
[0005]
[Means for Solving the Problem] Th manufacturing method of th heat sink by invention of a claim 1 The process which forms many slots which set a predetermined interval at l ast on one side among both sides of a plate-like substrate, and have a flute width [a little] larger than the thickness of the base of a plate fin in the shape of parallel, With the punch of the press equipped with the process which inserts the base of a plate fin in each slot on the substrate, and the plate-like part of the plate fin of between adjacent plate fins and ends which is made as [locate / outside / immediately] and has a cross-section V-like nose of cam in the shape of a ctenidium The nose of cam of a plate-like part is stuffed into the substrate flat part corresponding to each plate-like part, and it consists of a process which closes and stops the base both sides of the plate fin inserted in each slot.
[0006] The manufacturing method of the heat sink by invention of a claim 2 forms both the openings edge of the slot for plate fin base insertion in a cross-section convex arc, and is made to deform it plastically in invention of a claim 1, at the time of a caulking stop, so that field contact of a part of convex arc section may be carried out in the base of a plate fin.
[0007] For the thickness of 1-10mm and a plate fin, in invention of claims 1 or 2, the height of 0.05-2.0mm and a plate fin is [the thickness of a substrate / the pitch between centers of 10-150mm and a plate fin of the manufacturing method of the heat sink by invention of a claim 3] 1-10mm.
[0008] The manufacturing method of the heat sink by invention of a claim 4 The process which forms many slots which set an interval [a little] narrower than the inner width of face of the wave-crest section of a corrugated fin at least on one side among both sides of a plate-like substrate, and have a flute width [a little] larger than width of face outside the wave-crest section of a corrugated fin, The process which inserts the wave-crest section of one of the two of a corrugated fin in the slot on the substrate, and the process which has cross-section width of face [a little] smaller than the inner width of face of the wave-crest section, and inserts the rod for caulkings of the same quality of the material as a substrate in each slot through the aforementioned wave-crest section, With the punch of the press equipped with the plate-like part which is made as [locate / in the waves which a corrugated fin adjoins], and has a cross-section V-like nose of cam in the shape of a ctenidium The nose of cam of a plate-like part is stuffed into the rod for caulkings corresponding to each plate-like part, and while closing and stopping one side of the both-sides folding vertical section of the wave-crest section of the corrugated fin inserted in the slot, it consists of a process which carries out the pressure welding of the opposite side to a groove face.
[0009] In the above, the good aluminum or the good aluminium alloy (only henceforth "aluminum") of heat-conducting characteristic is used for a substrate, a plate fin, and a corrugated fin.
[0010]
[Embodiments of the Invention] The form of operation of this invention is explained with reference to a drawing below.
the form 1 of operation -- the form of this operation shows the manufacturing method of the heat sink of claims 1 and 2 by drawing 1 - drawing 4 , and drawing 7 First, many slots which set a predetermined interval on one side of the plate-like substrate made from aluminum, and have a flute width [a little] larger than the thickness of the base of a plate fin with forging are formed in the shape of parallel. That is, it is the bed (1) of the 1st press about a plate-like substrate. It carries and is a ctenidium-like suspension protruding line (2). Punch of the 1st press which it has in the shape of parallel (3) It pressurizes and is the above-mentioned predetermined slot (4). Substrate which it has (5) It makes. this tim -- slot (4) **** -- the thing which both the openings edg is formed [thing] in a cross-s ction convex arc, and makes the convex arc section (4a) provide -- it is -- punch (3) Ct nidium-like suspension protruding line (2) It is obtained by making the cross section into the configuration in which this is formed (refer to drawing 1 </A>). The above-mentioned slot (4) Although obtained with forging, you may form by

cutting.
[0011] Next, it is a substrate (5). It moves to the bed (illustration abbreviation) of the 2nd press, and is a substrate (5). Each slot (4) Plate fin (6) After inserting in a base (6a), adjacent plate fin (6) Plate fin (6) of between comrades and ends do to be located immediately outside -- and plate-like part (7) which has a cross-section V-like nose of cam (7a) Punch (8) (refer to drawing 2) of the 2nd press which it had in the shape of a ctenidium Each plate-like part (7) It is a plate-like part (7) to a corresponding substrate flat part (5a). A nose of cam (7a) is pushed in and it is a cross-section V-like indentation indentation (9) to this. While attaching, it is each slot (4). Inserted-in plate fin (6) Base (6a) both sides are closed and stopped (refer to drawing 3). It is a plate fin (6) in a part of convex arc section (4a) at the time of this caulking stop. A base (6a) is made to deform plastically so that field contact may be carried out, and the caulking stop section (4b) of large field contact is obtained (refer to drawing 4). plate-like part (7) vertical length -- plate fin (6) Substrate (5) from -- a part for the distance which carries out descent movement in order to stuff the nose of cam (7a) into a substrate flat part (5a) at least from projection height -- it is made for a long time
[0012] As the convex arc section may not not necessarily be in both the openings edge in a slot and it is shown in drawing 5 , it is an angle (10a). You may form the usual slot (10) which exists. In this case, it is the caulking stop section (10b) of the narrow field contact near a line contact to drawing 6 at the time of a caulking stop. It will obtain. therefore, plate fin (6) you stop making it go away -- front slot (4) **** -- it is more desirable for the convex arc section (4a) to be in both the openings edge
[0013] It is a substrate (5) as shown in drawing 7 through the above-mentioned process. Although a field with a fin and an opposite side obtain heating element clamp faces (11), such as a semiconductor device, and the heat sink (12) with which it was made before a caulking stop and punch (8) **** -- substrate (5) Each slot (4) Plate fin (6) After inserting in a base (6a) Adjacent plate fin (6) Plate fin of between comrades and ends (6) Plate-like part of the shape of a ctenidium made as [locate / outside / immediately] (7) Since it has Each plate fin (6) It will be inserted from the both sides and is a plate fin (6). It can prevent falling.
[0014] Although the form of a plate fin has the common rectangle-like thing to which processing of what as shown in drawing 7 is not given, either (Refer to drawing 8), [the plate fin (14) with which two or more vertical long holes (13) were opened, and] (Refer to drawing 9), [the plate fin (16) with which two or more vertical long notches (15) were opened from the top, and] Base (18a) The plate fin (18) (refer to drawing 10) and base (19b) which leave with a flat and have up the wavelike section (17) crooked wavelike [in view of a flat surface] after this It leaves with a flat. A thing like a plate fin (19) and (referring to drawing 11) which has the taper section (20) which made the upper part with the taper after this is also adopted suitably.
[0015] the form 2 of operation -- the form of this operation shows the manufacturing method of the heat sink of a claim 4 by drawing 12 - drawing 13 The 1st press is used in the same way as the form 1 of operation. first, with forging It is the wave-crest section (21a) of a corrugated fin (21) with an angle to one side of the plate-like substrate made from aluminum. An interval [a little] narrower than inner width of face (W1) is set, and it is the wave-crest section (21a) of a corrugated fin (21). While forming many 1st slot (22) which has a flute width [a little] larger than outside width of face (W2) The 2nd slot (23) which sets the respectively same interval as the above, and has a flute width [a little] larger than the thickness of the perpendicular edge (21b) of a corrugated fin (21) is formed in the outside of this slot on the ends (22), and the substrate (24) which has two kinds of slots (22) and (23) is obtained.
[0016] Next, a substrate (24) is moved to the bed (illustration abbreviation) of the 2nd press, and it is the wave-crest section (21a) of one of the two of a corrugated fin (21) to the 1st slot (22) on the substrate (24). While inserting in It is the perpendicular edge (21b) of a corrugated fin (21) to th 2nd slot (23) on the substrate (24). Aft r inserting in, It is the aforementioned wave-crest section (21a) to the 1st slot (22). It minds and is the wave-crest section (21a). It has cross-section width of face [a little] smaller than inner width of face (W1), and the rod for caulkings (25) of the same quality of the material as a substrate (24) is inserted in (r fer to drawing 12). then, the vertical section of the waves and ends wh re a corrugated fin (21) adjoins ach other -

- do to be located immediately outside -- and cross-section V-lik nose of cam (26a) The plate-like part (26) which it has with the punch (27) of the 2nd press which it had in the shape of a ctenidium The rod for caulkings (25) and substrate flat part (24a) corresponding to ach plate-like part (26) Nose of cam of a plate-like part (26) (26a) It pushes in. While the indentation (35) of a cross-section V type is attached to these The wave-crest section of the corrugated fin (21) inserted in the 1st slot (22) (21a) One side of a both-sides folding vertical section, and perpendicular edge of a corrugated fin (21) (21b) While closing and stopping one side, the pressure welding of these opposite sides is carried out to a groove face. A field with the fin of a substrate (24) and an opposite side obtain a heating element clamp face (28) and the heat sink (29) with which it was made.

[0017] It is the superior horn (25a) of the rod for caulkings (25) at the time of this caulking stop. It reaches and is the wave-crest section (21a) of a corrugated fin (26) about the superior horn (23a) outside a slot (23). One side of a both-sides folding vertical section, and perpendicular edge of a corrugated fin (21) (21b) You make it deform plastically so that one side may be contacted, and the caulking stop section (25b) (23b

[0018] Although a heat sink (29) is obtained through the above-mentioned process It is the wave-crest section (21a) of one of the two of a corrugated fin (21) to the 1st slot (22) of before a caulking stop and a substrate (24). While inserting in It is the perpendicular edge (21b) of a corrugated fin (21) to the 2nd slot (23) on the substrate (24). It is the aforementioned wave-crest section (21a) to the 1st slot (22) after inserting in. Since it minds and the rod for caulkings (25) is inserted in, a corrugated fin (21) keeps the posture right. In addition, in the thing of the shape of not the letter of suspension but a standup, the 2nd slot (23) is unnecessary like illustration of the both sides of a corrugated fin.

[0019] the gestalt 3 of operation -- the gestalt of this operation shows the manufacturing method of the heat sink of different claims 1 and 4 from the manufacturing method of the heat sink of drawing 1 - drawing 4 , and drawing 7 by drawing 14 , and this inclines toward both sides of a substrate (30), makes them possess a fin (31) and (32), and obtains the heat sink (34) which made the remaining both-sides flat sides with the heating element clamp face (33) As for both the heating element clamp face (33), one of one side or both sides are used if needed. Any of the above-mentioned plate fin and a corrugated fin are sufficient as the gestalt of a fin.

[0020]

[Example] It sets to the heat sink of drawing 7 , and is a substrate (5). They are 5.0mm and a plate fin (6) about thickness (tb). They are 1.0mm and a plate fin (6) about thickness (tf). Height (H) 20.0mm and plate fin (6) Length (L) 75.0mm and plate fin (6) Pitch between centers (P) You may be 5.0mm.

[0021] In this example and the example of comparison which soldered the substrate and the plate fin with the above-mentioned size and this size, the result which the wind speed was changed and investigated thermal resistance is shown in the graph of drawing 15 . Although the line (b) of this graph is the thing of an example and a line (b) is the thing of the example of comparison, both do not have the difference of thermal resistance and it understands [demonstrating the equivalent performance or]. In the heat sink of the above-mentioned example, the fin efficiency and thermal resistance at the time of changing the size of each part now are shown below.

[0022] Drawing 16 shows the thickness (tb) of a substrate, and the relation of fin efficiency. Although the whole fin efficiency improves so that the thickness (tb) of a substrate is thick, since a weight will increase notably if too thick, it is not realistic. Moreover, if too thin, the whole fin efficiency will fall extremely. Therefore, the thickness (tb) of a substrate is a range (A) with 1-10 suitablemm.

[0023] Drawing 17 shows the fin efficiency at the time of changing the thickness (tf) of the plate fin in low wind-sp ed conditions comparatively. Although fin efficiency will improve if fin efficiency falls [thickness (tf)] extremely by less than 0.05mm and thickn ss (tf) increas s, if too thick, the weight of a h at sink incr as s and it is not realistic. Therefore, th range of 0.05-2.0mm (B) is suitable for the thickness (tf) of a plate fin.

[0024] Drawing 18 is the h ight (H) of a plate fin. The relation of fin efficiency is shown. h ight

(H) of a plate fin although a low is good, since the thermolysis eff ct becomes small in order that the increas in heat transfer area may d creas , if too low, I think that it is 10mm as a r alistic minimum, and a upper limit is 100mm if fin efficiency is taken into consid ration on the other hand -- having -- height (H) of a plate fin The suitable range (C) is 10-100mm.
[0025] Drawing 19 is the pitch betw en centers of a plate fin (P). The relation of thermal resistance is shown. Pitch between centers of a plate fin (P) Since heat transfer area will decrease and a heat transfer rate will also fall if it exceeds 5mm, thermal resistance becomes large. Moreover, pitch between centers of a plate fin (P) Although thermal resistance becomes small so that it is small, fin efficiency becomes small, in order to coalesce in the boundary layer of the plate fin with which the boundary layer adjoined each other, if it becomes large too much. Furthermore, pitch between centers of a plate fin (P) If too small, pressure loss increases extremely and is not realistic. Therefore, pitch between centers of a plate fin (P) The range of 0.5-5.0mm (D) is suitable.
[0026]
[Effect of the Invention] According to the manufacturing method of the heat sink of this invention, use of the punch of easy structure is sufficient, and since another parts are not especially needed for front fin posture maintenance of the caulking stop of a fin, a heat sink can be manufactured cheaply and efficiently.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is notch **** front view about the state of forming a slot in a substrate from forging.
[Drawing 2] It is the front view showing the state before closing a plate fin to a substrate and stopping it in the gestalt 1 of operation of this invention.
[Drawing 3] It is the front view showing the state after closing this plate fin to a substrate and stopping it.
[Drawing 4] It is the partial detailed expanded sectional view showing the state where the base of a plate fin was closed and stopped to the substrate in drawing 3 .
[Drawing 5] It is the fragmentary sectional view showing the state where prepared the usual slot which has an angle in a substrate, and the base of a plate fin was inserted in this.
[Drawing 6] It is a cross section equivalent to drawing 4 which closed and stopped the base of a plate fin to the substrate which has a slot on drawing 5 .
[Drawing 7] It is the partial perspective diagram of the heat sink manufactured according to the gestalt 1 of operation.
[Drawing 8] It is the perspective diagram showing the 1st modification of a plate fin.
[Drawing 9] It is th p rspective diagram showing the 2nd modification of a plate fin.
[Drawing 10] It is the perspective diagram showing the 3rd modification of a plate fin.
[Drawing 11] It is the perspective diagram showing the 4th modification of a plate fin.

[Drawing 12] It is the front view showing the state befor closing a plate fin to a substrate and stopping it in the gestalt 2 of operation of this invention.
[Drawing 13] It is the front vi w showing the state after closing this plate fin to a substrate and stopping it.
[Drawing 14] It is the side elevation of the heat sink obtained according to the gestalt 3 of operation of this invention.
[Drawing 15] It is the graph which shows the thermal resistance at the time of changing the wind speed in an example and the example of comparison.
[Drawing 16] It is the graph which shows the thickness of a substrate, and the relation of fin efficiency.
[Drawing 17] It is the graph which shows the fin efficiency at the time of changing the thickness of the plate fin in low wind-speed conditions comparatively.
[Drawing 18] It is the graph which shows the height of a plate fin, and the relation of fin efficiency.
[Drawing 19] It is the graph which shows the pitch between centers of a plate fin, and the r lation of thermal resistance.
[Description of Notations]
(2) : ctenidium-like suspension protruding line
(3), (8), (27): Punch
(4) : slot
(4a): Convex arc section
(4b) (10b) (23b) (25b) : caulking stop section
(5), (24), (30) : Substrate
(5a) (24a) : substrate flat part
: (6a) The base of a plate fin (18a) (19b)
(7), (26) : Plate-like part
(7a) (26a) : cross-section V-like nose of cam of a plate-like part
(12), (29), (34): Heat sink
(6), (14), (16), (18), (19) : Plate fin
(21): Corrugated fin
(21a) : the wave-crest section of a corrugated fin
(21b) : the perpendicular edge of a corrugated fin
(22): The 1st slot
(23): The 2nd slot
(25): The rod for caulkings
: (W1) Inner width of face of the wave-crest section
: (W2) Width of face outside the wave-crest section

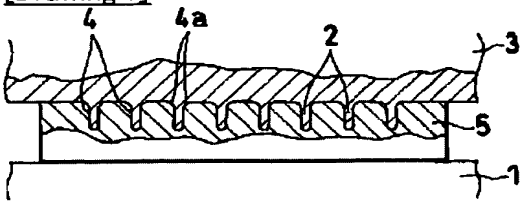
[Translation done.]

* NOTICES *

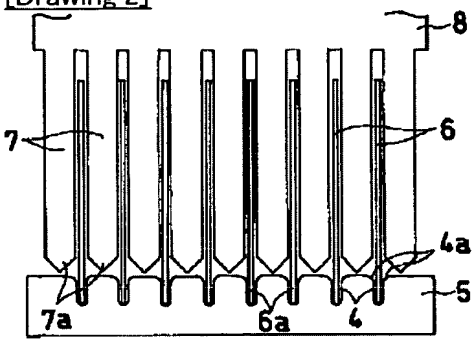
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translat d.

DRAWINGS

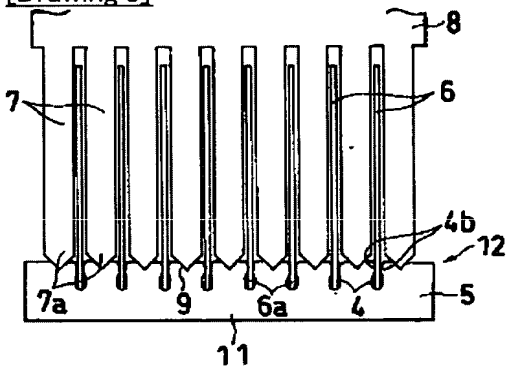
[Drawing 1]



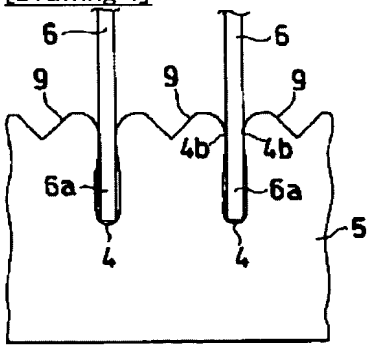
[Drawing 2]



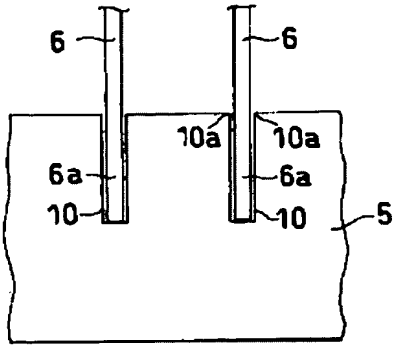
[Drawing 3]



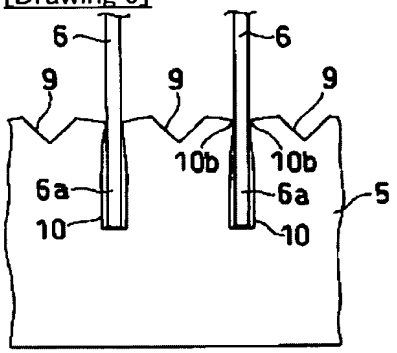
[Drawing 4]



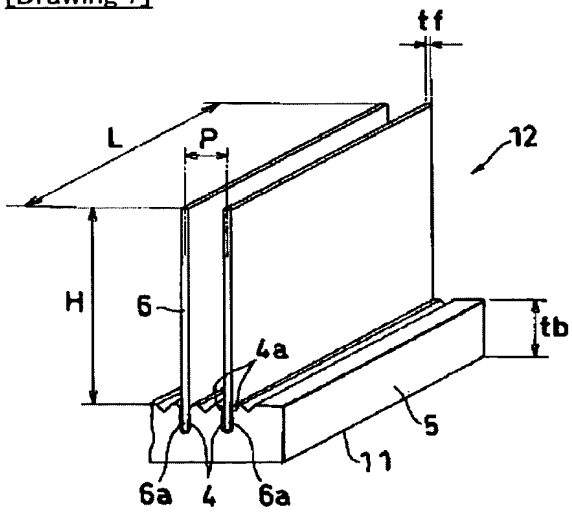
[Drawing 5]



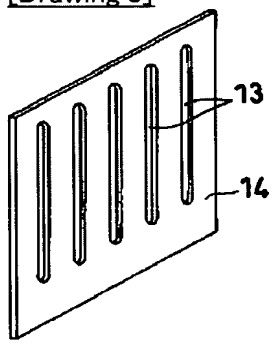
[Drawing 6]



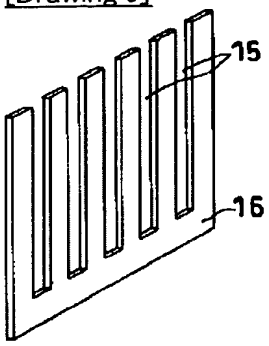
[Drawing 7]



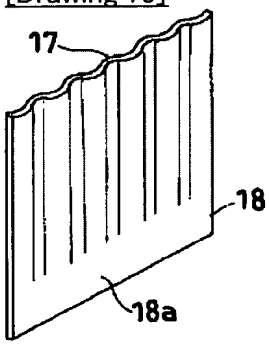
[Drawing 8]



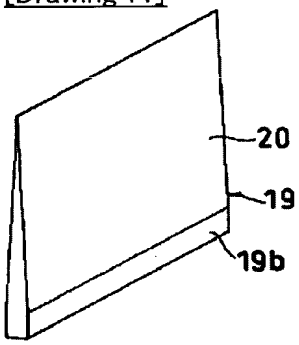
[Drawing 9]



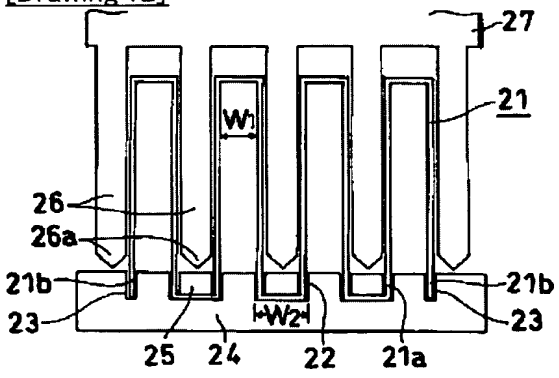
[Drawing 10]



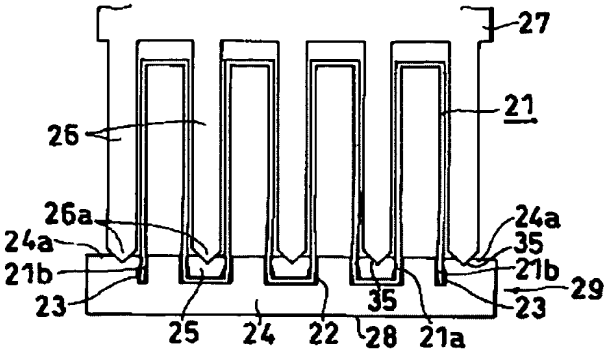
[Drawing 11]



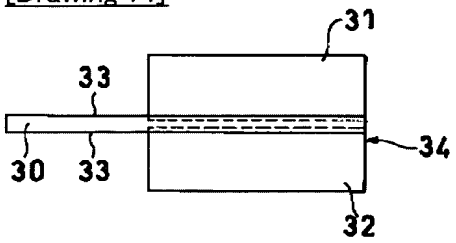
[Drawing 12]



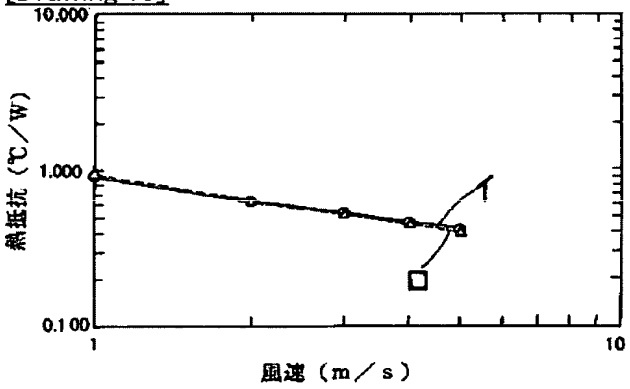
[Drawing 13]



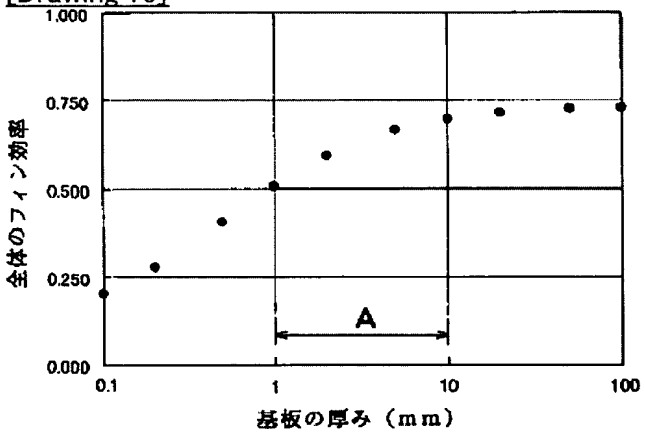
[Drawing 14]



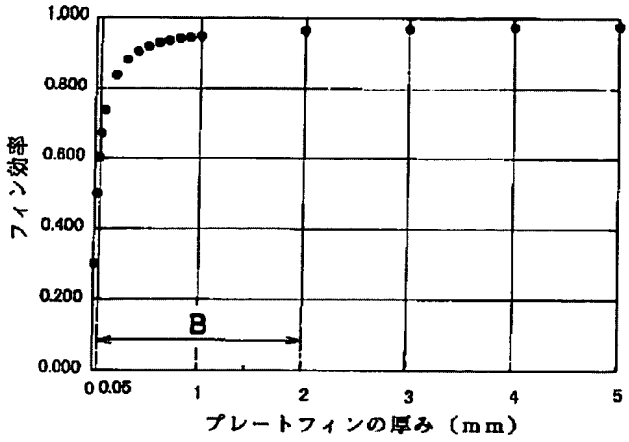
[Drawing 15]



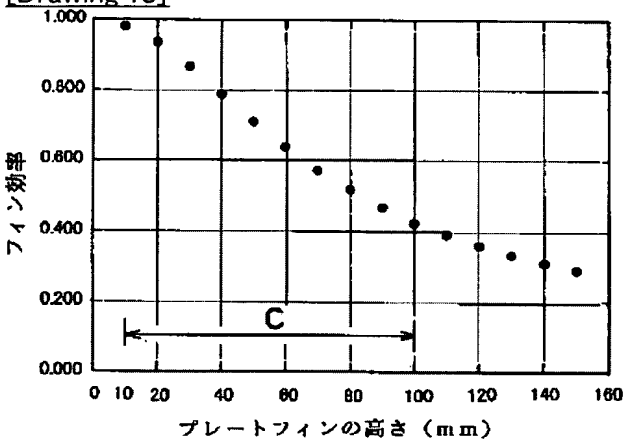
[Drawing 16]



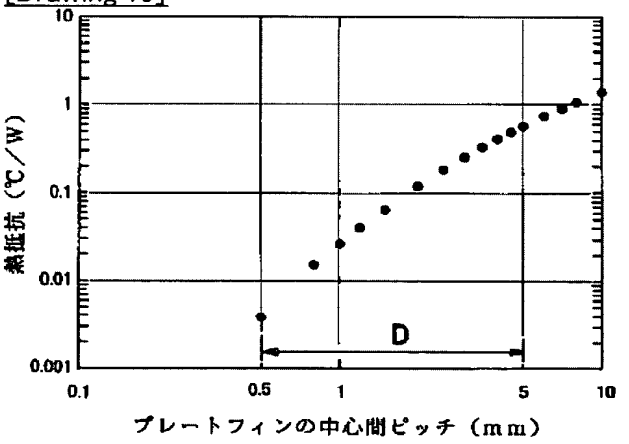
[Drawing 17]



[Drawing 18]



[Drawing 19]



[Translation done.]